INSTRUCTIONS:

(1) DO NOT OPEN YOUR EXAM BOOKLET UNTIL YOU HAVE BEEN TOLD TO BEGIN.

(2) The total for the exam is 100 points

(3) There are 8 pages with 32 problem; 15 multiple-choice, 15 short answer, and 2 free response.

(4) **You may skip one multiple-choice and one short answer problem** for a total of 5 points.

(5) Use the backside of the paper as your scratch paper. The backside is not graded.

(6) If you make a mistake, cross it out or erase it. Otherwise, it will be graded, for better or for worse.

(7) No electronic devices (e.g. phones, calculators, mp3 players, etc.) are allowed.

(8) You are allowed one sheet of notes on Letter paper or smaller.

(9) Write your name on the upper-right corner of each page of the exam.

(10) **To receive full credit, you must write legibly and your answers must be clear.** You may need to sketch out answers to less straightforward problems on the scratch side before you write on the front side.

(11) Do not leave classroom until you have handed in the exam.

(12) The exam lasts 110 minutes
(1) (2 pts) Given the declaration `int i = 5;` what does `i++;` return?

(a) 0
(b) 5
(c) 6
(d) Undefined
(e) None of the above

(2) (2 pts) For the following code snippet:

```cpp
long lng1 = 10;
long &lng2 = lng1;
```

What does the `&` signify?

(a) Take the Boolean-and of `lng1` and `lng2`
(b) Treat `lng2` like a reference type
(c) Extract the memory address of `lng2`
(d) This expression is illegal (it will not compile)
(e) None of the above

(3) (2 pts) For the following code snippet:

```cpp
long lng1 = 123;
long *val = &lng1;
```

What does the `&` signify?

(a) Take the Boolean-and of `lng1`
(b) Treat `lng1` like a reference type
(c) Extract the memory address of `lng1`
(d) This expression is illegal (it will not compile)
(e) None of the above

(4) (2 pts) Given the following code snippet:

```cpp
unsigned int my_var = 0;
my_var = my_var - 1;
```

Which of the following statements are true?

(a) `my_var` has the value -1
(b) `my_var` has the value 0
(c) `my_var` has the value $-2,147,483,648$ (that is $-2^{31}$)
(d) `my_var` has the value $4,294,967,295$ (that is $2^{32} - 1$)
(e) None of the above
(5) (2 pts) Which of the following Unix command line commands will copy a file?
   (a) copy
   (b) cp
   (c) mv
   (d) c
   (e) None of the above

(6) (2 pts) On the command line, the unix command cd .. does what?
   (a) Print the current directory
   (b) Select as the current working directory the first child directory
   (c) Copies all the elements in the current directory to the special cd directory
   (d) Select as the current directory the parent directory
   (e) None of the above

(7) (2 pts) Given the decimal value 17, which of the following statements are true?
   (a) Hexadecimal equivalent is 0x11
   (b) Binary equivalent is 0b10001 (C++14 notation)
   (c) Octal equivalent is 021
   (d) All of the above
   (e) None of the above

(8) (2 pts) What is the return type of the expression cout << 14;?
   (a) No return, a void type
   (b) long
   (c) int
   (d) char
   (e) None of the above

(9) (2 pts) Which of the following are true about the terms lvalue and rvalue?
   (a) An rvalue represents a value
   (b) An lvalue represents a memory location
   (c) rvalue is on the right and lvalue is on the left of an assignment statement
   (d) All of the above
   (e) None of the above
#include <iostream>
using std::cout; using std::endl; using std::boolalpha;

int main() {
    cout << boolalpha;
    long lng = 2;
    double dbl = 3.4;
    
    long &amp_lng = lng;
    long *star_lng = &lng;
    
    cout << amp_lng << endl; // line 1
    cout << (&amp_lng == &lng) << endl; // line 2
    lng = 4;
    cout << star_lng << endl; // line 3
    auto result = *star_lng * dbl; // line 4
    cout << result << endl; // line 5
    cout << amp_lng++ << endl; // line 6
}

(10) (2 pts) What is the output produced by Line 1?
(a) 0
(b) 1
(c) 2
(d) 4
(e) None of the above

(11) (2 pts) What is the output produced by Line 2?
(a) true
(b) false
(c) 0
(d) 1
(e) None of the above
(12) (2 pts) What is the output produced by Line 3?
   (a) some address
   (b) 1
   (c) 2
   (d) 4
   (e) None of the above

(13) (2 pts) What is the type of result on Line 4?
   (a) long
   (b) long reference
   (c) long pointer
   (d) bool
   (e) None of the above

(14) (2 pts) What is the output produced by Line 5?
   (a) 3.4
   (b) 13.6
   (c) 6.8
   (d) 2.0
   (e) None of the above

(15) (2 pts) What output is produced by Line 6?
   (a) some address
   (b) 1
   (c) 2
   (d) 4
   (e) None of the above


```
string fn1(string arg_s, int cnt) {
    for (int i = 0; i < cnt; ++i) {
        arg_s = arg_s.substr(1) + arg_s[0];
    }
    return arg_s;
}

(16) (3 pts) If s = "abcdef", what is the result of calling fn1(s, 2)?

(17) (3 pts) What is the value of s?

string fn2(string arg_s, char c1, char c2) {
    string result;
    for (auto ele : arg_s) {
        if (ele < c1) || (ele > c2)
            result += ele;
    }
    return result;
}

(18) (3 pts) What is the type of ele in fn2?

(19) (3 pts) What is the result of calling fn2("abcdefg", 'c', 'e')?

(20) (3 pts) What is the result of calling fn2("abcdefg", 'e', 'c')?

long fn3(double dbl1, double dbl2) {
    long lng = static_cast<long>(dbl1);
    double r = dbl1 - lng;
    if (r >= dbl2)
        return lng + 1;
    else:
        return lng;
}

(21) (3 pts) What is the result of calling fn3(123.75, 0.5)?

(22) (3 pts) What is the result of calling fn3(17.5, 0.5)?
long fn4(long lng) {
    long result = 0;
    for (int i = 1; i <= lng; ++i) {
        if (lng % i == 0)
            result += i;
    }
    return result;
}

(23) (3 pts) What is the result of calling fn4(12)?

(24) (3 pts) What is the result of calling fn4(31)?

long fn5(long lng) {
    long result = 0, r = 0;
    while (lng > 0) {
        r = lng % 10;
        result += r;
        lng /= 10;
    }
    return result;
}

(25) (3 pts) What is the result of calling fn5(12)?

(26) (3 pts) What is the result of calling fn5(31)?

long fn6(long lng) {
    return (lng % 2) ? lng * 2 : lng / 2;
}

(27) (3 pts) What is the result of calling fn6(12)?

(28) (3 pts) What is the result of calling fn6(31)?
int fn7(int n) {
    int result = 0;
    for (int i = 1; i < n; i += 3) {
        if (i % 2):
            result *= 2;
        else:
            result += i;
    }
    return result;
}

(29) (3 pts) What is the result of calling fn7(9)?

(30) (3 pts) In problem 29, how many iterations of the for loop occur?
(31) (15 pts) Write a function `IsPalindrome` that returns `true` if and only if its `const string&` parameter reads the same forward and backward. For example, “racecar” is a palindrome but neither “race” nor “car” are palindromes. You may assume that the input is only alphabetic (you don’t need to treat symbols specially).

(32) (15 pts) Write a function `FizzBuzz` that prints out each integer from 1 to parameter `n` (inclusive) except that if the number is divisible by 3 it prints “fizz” and if it is divisible by 5 it prints “buzz” (if it is divisible by both it should print “fizzbuzz”). Each number should be printed on a new line.